Toxic gas detection and monitoring utilizing internet of things

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TOXIC GAS DETECTION AND MONITORING UTILIZING INTERNET OF THINGS

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ABSTRACT

Harmful gas leakage accidents are the main reason for workers death in industries which work mainly using chemicals. Gas leakage can be easily detected and controlled by using latest trends in information technology by applying internet of things. This project intended to avoid industrial accidents and to monitor harmful gases and to intimate alert message to safety control board of industry using Arduino Uno R3 and internet of things. Ardunio Uno R3 board is used as central microcontroller which is connected with sensor. Such as temperature, gas sensor, alcohol sensor which can continuously monitor respective environmental parameters. Hence this device may be used as multi gases detection apparatus more over the rate of response is high. An alarm is produced instantly if the level of the gases goes above the normal level means indication through the internet specific receiver section. Data received by sensor is stored in internet which can be used for further processing and it can be analyzed for improving safety regulations. This model can be future extended for providing better living environment for people in and around industries with a pollution controlled environment

Key words: Ardunio Uno R3, gas sensor, radiation sensor, Wi-Fi module, internet of things.

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1. INTRODUCTION

These days harmful gases leakage is the main reason for industrial accidents and depths of workers in industries. Pollutants released by industries in to atmosphere is also a cause for the environmental pollution and such the reason greatly effects humans and animals health by minimizing the levels of oxygen and increasing the levels of harmful gases like ammonia, carbon monoxide, nitrogen trifluoride, sulfur hexafluoride etc,, .These gases are mainly the

reason for increasing the no of pollutants in atmosphere. These environmental pollutants are mainly released by industries working with chemicals. Industries management only have a eye on profits and consider environmental safety as least priority which in turn affects the atmosphere and industrial workers health who are living in and around industries as the level of harmful gases are high around industrial areas compared to normal living places. As the population depends more on usage of oil, gas and coal for generating energy to meet the energy demand by increasing population the release of harmful pollutants increases day by day .it is observed that about a 1.1 billion of human population respiration is done through unhealthy air and recorded 7 million deaths occur globally [9, 10].Industries started peoples or industries owner fully focus on the profit oriented. They do not focus on the workers, people safety and environment safety also. Generally industries are located in the outside cities. But some industries are located at the middle of the cities and village because of the transport reasons or for the availability of raw materials. Due to human error and machine failures etc gas leakage accidents occur often but ceases many workers in to death beds. Gas leakage and detection of gas leakages and harmful gases in and around industries and can be effectively handled by using sensors and automation using IoT . Here we developed a basic model for detection of harmful gases and measurement of harmful gases on a self-calibrated ppm scale and notifying the workers of industry by sms in case any gas leakage is occurred in any sector of the industry.

Hardware System Of Proposed

This system using limited gases sensor and limited radiation sensor these sensors are collecting data transmitting using Wi-Fi module to internet of things module. Most dangerous area accidents occur time intimated data sending speed is high must need. Iot module using transmitting and receiving data range is high and extendable as possible [1] & [2]. The poisonous gas and radiation or leakage monitoring process of the system marked with the importance of real-time detection and control of the poisonous gas and radiation so as to automate the controlling and monitoring system for real time utilization [7].

2. RELATED WORKS

The existing system used zigbee module transmitting and receiving information data bit rate is 250 kilo bits per second [6]. This system is mainly used Wi-Fi module transmitting and receiving information data bit rate is 54 mega bits per second. Wi-Fi module using getting information very quickly to reach desired designation or location peoples or related government officers.

Hard Ware Used

- Ardunio Uno R3
- Mq2 gas sensor
- Mq7 gas sensor
- Mq135 gas sensor
- radiation sensor
- Alarm
- Temperature sensor lm35
- Wi-Fi module
- IoT module
- LCD display

Software Used

- Arduino
- Proteus

MQ2 Sensor

The MQ2 family of sensors has a tiny heater inside along with an electro-chemical sensor. They react for range of gases at the room temperature. An analog signal and can be read with an analog input of the Arduino as the output of each sensor. The main objective of the overall system is to detect poisonous gas and radiation leakage. In case any toxin gases or radiation present in industries areas that gases or radiation mainly affected by the industries surrounding areas living peoples. Some gases continuous breathing means kill the human begin and environment mixed this gas or radiation polluted environment condition. If the gases are odorless will be exposed to it for a long time which may cause serious health problems. Gases like CO (carbon monoxide) are odourless which with concentration above 350ppm cause confusion and fainting, above it will surely kill individual. Each gas has its own physical and chemical properties, which make them difficult to analyse without any instrument. Toxic gases present in various levels depending on the concentration and density of it. Gas sensor working Gas molecule to absorb IR light each gas molecule absorption having particular wave length. Wavelength based identified gases. radiation sensor working It measure the number of counts striking per minute detected by the Geiber tube .temperature sensor sensing temperature condition this all sensor gathering data send to Ardunio Uno R3 board. Ardunio board micro controller already programmed that program that program operation based on gases and radiation monitoring level. Suppose getting sensor value level is high means indicated the nearest fire station, this indication based save industries surrounding people life. Device placed area having LCD display it display any leakage occurring time indication display. Wi-Fi module using transmitting data speed rate is high. Compare to zigbee module.

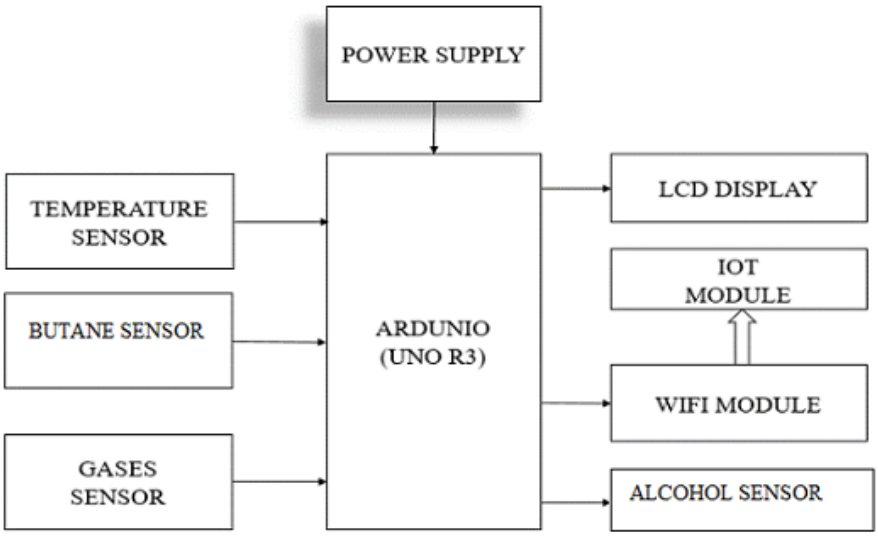


Figure 1 Block diagram of system

Express if Systems has designed this shield based on esp8266, pin-compatible with Arduino UNO/Mega2560 Dev Borad. This module can be used to to add Wi-Fi functionality for existed microcontroller project design with a UART serial connection. This Wi-Fi module should be reprogrammed to convert in to standalone Wi-Fi connected device .The features it

includes are A 802.11 b/g/n protocol Wi-Fi Direct (P2P), soft-AP Integrated TCP/IP protocol stack. MQ-2 Gas Sensor module is used for home and industries to check for gas leakage detection.

MQ7 Sensor

This is a Carbon Monoxide (CO) sensor which can be easily utilized, appropriate in detecting cabon particles gas radiation noticeable focusing all around. This MQ-7 sensor has a range of 20 to 2000 PPM for detecting carbon particles gas radiation .This sensor is having high affectability with quick reaction time.

MQ135 Sensor

SnO2 has the lower conductivity in the clear air which is used by Mq135 gas sensor as gas-sensing material. The conductivity of this gas sensor increases as the concentration of gas that polluting the atmosphere increases. MQ-135 is highly effective in detecting gas that belongs to sulfide, ammonia and benzene steam and in general it also detects smoke in surrounding atmosphere. It is very cost friendly and applicable for detecting no of harmful gases so MQ135 is a ideal choice for different gas detecting applications.

Linear Monolithic 35 Sensors

The LM35 family is an precision ic(integrated-circuit) temperature detecting devices which outputs the voltage that is directly proportional to that of temperature in centigrade units. This LM35 sensor is different when compared with the linear sensors measuring temperature which are calibrated with kelvin units, since the user has no need subtract the large constant voltage value from the output to get the convenient value of Centigrade scaling. The LM35 sensor do not require any type of external calibration or any trimming for providing with the accuracies of ±1/4 degrees centigrade at room temperature and ±3/4 degrees centigrade over the full −55°C to 150°C range of temperature. Lower cost can be guaranteed by trimming and with calibration at wafer level. Interfacing for readout or control circuitry is especially easy as Lm135 sensor has low-output impedance, linear output, and a precise inherent calibration. This device can be utilized with a single power supplies, or plus and minus supplies can also be used. Since the LM35 device only draws 60 μAmps through the power supply source, hence it have the low self-heating of less than 0.1°C in the still air. This linear monolithic 35 (LM35) sensor has been rated for operating in between a −55°C to 150°C temperature range

Wi-Fi Module

ESP8266-Based Serial Wi-Fi Shield for Arduino is planned and created by Shenzhen Doctors of Intelligence &Technology (SZDOIT). At long last Cloud Server will apply information mining on informational indexes. It likewise mail or SMS Technician and send points of interest to the Owner (mail or SMS). We can interface any number of clients on cloud server so it underpins multi client framework attributes. Here we can utilize just a single cloud server yet we can associate many quantities of users to it by means of pc, or any android gadgets

LCD Display

The LCD (Liquid Color Displays) for Arduino gives a straightforward correspondence between the client and the electronic framework in a simple and justifiable dialect. For any microcontroller, perusing and composing the characters to the LCD is the need errand, and among of microcontrollers, Arduino is the best. Arduino is an extraordinary stage for prototyping to interface the LCD shows, actuators, sensors, and so forth. Contingent upon your necessities and prerequisites.

IOT Module

We utilize distinctive sensors (light, temp, and level, stickiness) to gather the information to comprehend the ecological conditions and furthermore to recognize any blame in gadgets. It is important to act gadgets as indicated by the occupant prerequisite. Home PC ceaselessly screens sensors esteems and control the gadgets as needs be. In the event that issue discovered it answer to cloud server. Here client can alter a few settings and see the gadgets usefulness and working. We assemble one Registration Application where Technicians and other specialist co-op will enroll on it. They are given administration timing and so forth.

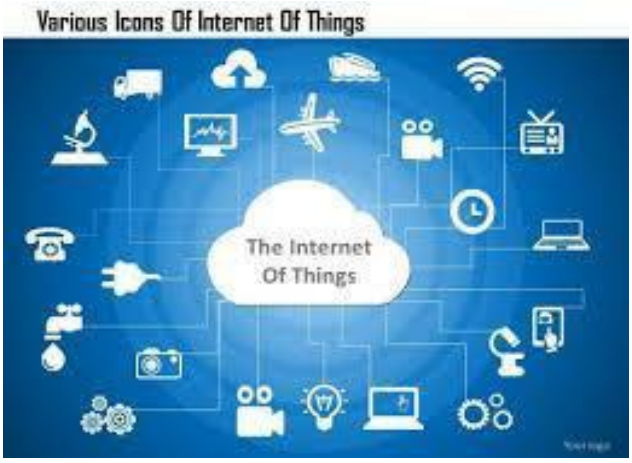
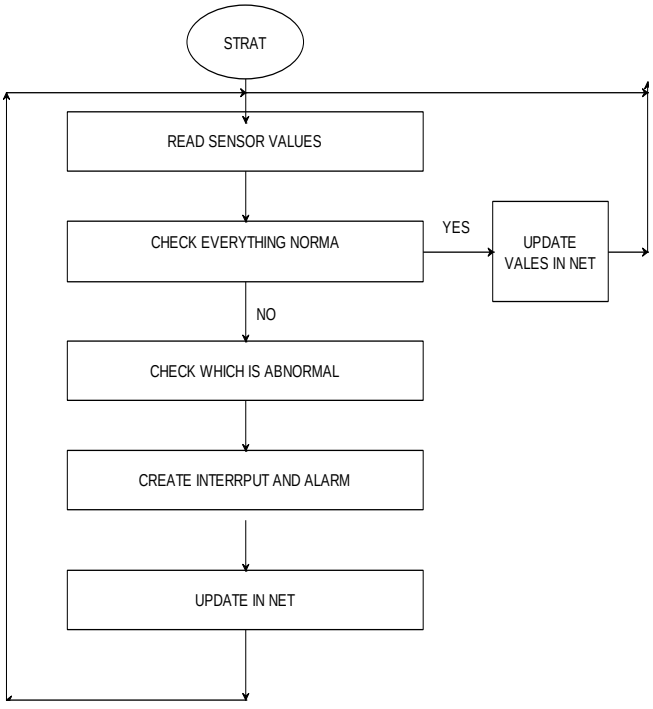


Figure 2 Various icon using iot

Algorithm



Sensors continuously monitors the gases in the surrounding and posts in to the server for storing and usage of data futurly. While continuously monitoring if any gas level exceed the range to that of normal range in air the alert will be enhanced and a SMS notification will be posted to safety control board of organization and even to the workers mobile station only if required. In figure 5 it carries the syntax of parameter (maximum permissible value) = value

detected at the moment. If value detected at that particular moment is greater than that of maximum permissible value an SMS has sent by imitating the GMS module through commands programmed in micro controller.

Alaram

The caution or signal utilizing this framework primary reason is demonstrated to ready working individuals and staying individuals moved wellbeing place spare the general population life and condition.

Power Supply

6 to 20 volts power supply should be given to turn on the board. On the off chance that provided with under 7V, in any case, a 5volts stick will supply under with five volts and the board might be unsteady. On the off chance of utilizing more than that of 12V, the voltage controller unit may get overheated and can harm the board. The range prescribed is 7 to 12 volts. I've discovered that utilizing 9V functions admirably. You can essentially interface the + end of your battery to Arduino VIN and the conclusion to Arduino ground. You should see the green light on the Arduino swing on to demonstrate that it is controlled. It's additionally a smart thought to connect a flip switch in arrangement with this battery so you can kill your Arduino and on. Arduino is controlled by the USB link originating from the PC. Notwithstanding, here and there you need to assemble frameworks that will be self-governing and controlled by a battery. To control the Arduino, you will require a battery. The best is to control the Arduino specifically from the battery, so you don't need to utilize any voltage controllers that will suck some power.

Proteus 8.0 Professional

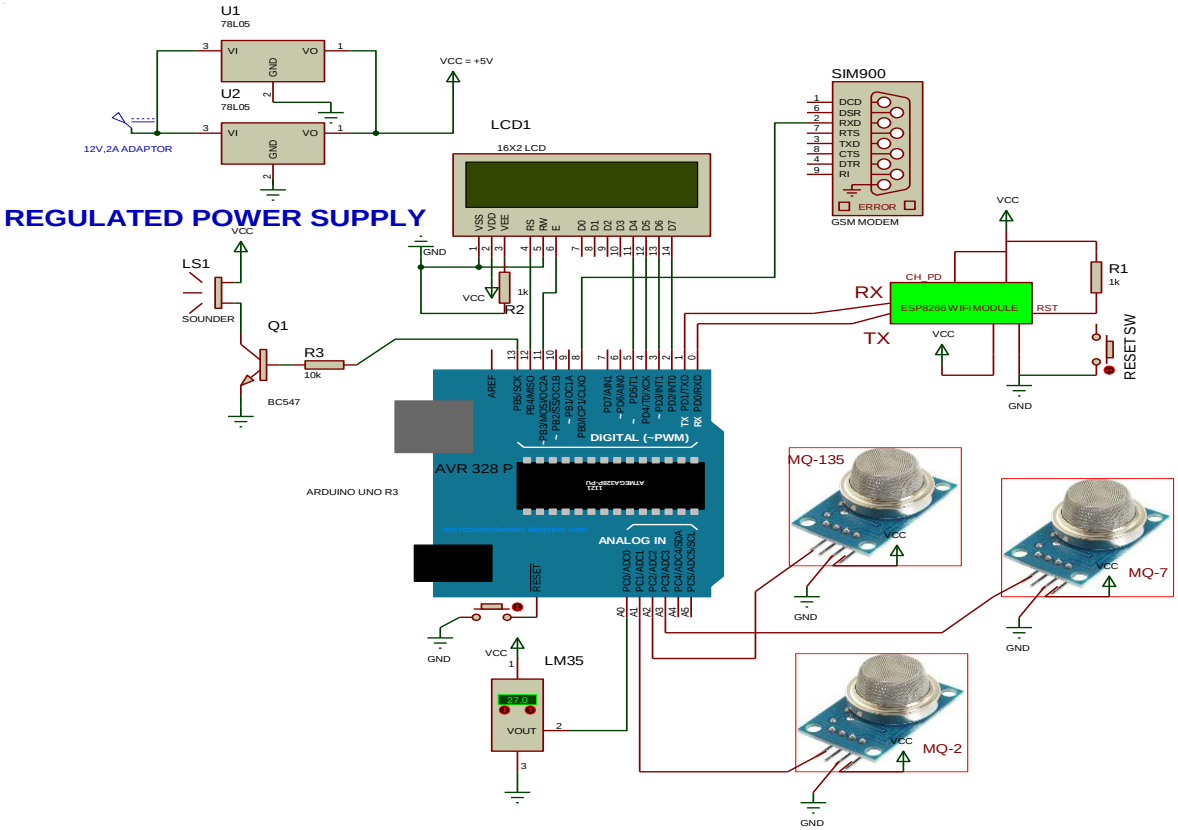


Figure 3 The Proteus software using simulation layout

Proteus 8.0 expert is a best re-enactment for different plan with Ardunio Uno r3. It's for the most part prominent in light of accessibility of all microcontrollers in it. So it's helpful instrument to test programs and inserted plan for hardware specialist. You can reenact your programming of Ardunio Uno r3 in Proteus 8.0 Simulation Software. In the wake of reenacting your circuit in Proteus 8.0 Software. Proteus is the application for making virtual System Modeling and circuit Simulations. Proteus additionally can reproduce the cooperation between programming running on an Ardunio Uno r3 and any simple or computerized gadgets associated with it. Proteus can recreates output and input ports, interferes with, clocks USART and every other fringe show on each help processor.

3. RESULT

Display has been reenacted by utilizing by Proteus Software to screen the noxious gas and radiation location utilizing distinctive sensors. The adjustment in, carbon monoxide, smelling salts, radiation, methane will be recognized by separate sensors and can be resolved. Figure 4 shows the prototype for the system design .figure 5 shows the SMS notified when harmful gases levels have been raised from normal level to harmful level. Fig6 shows the values of gases that are continuously detected by the sensors having a temperature sensor is a added minimum requirement besides gas sensor.

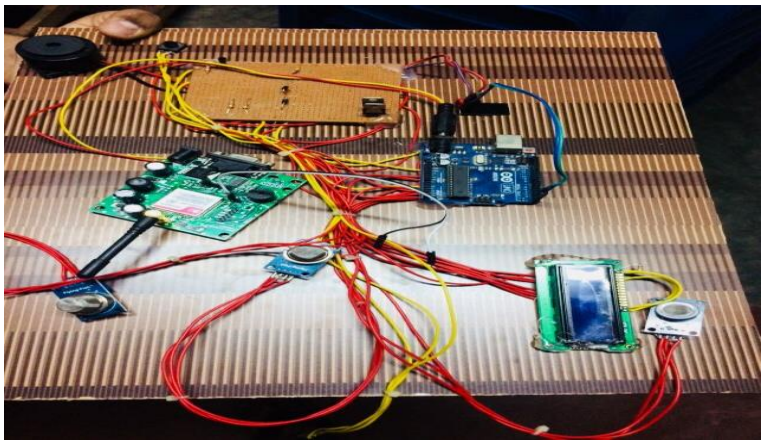


Figure 4 Complete experimental setup

Figure 5 SMS alert results for different toxic gases

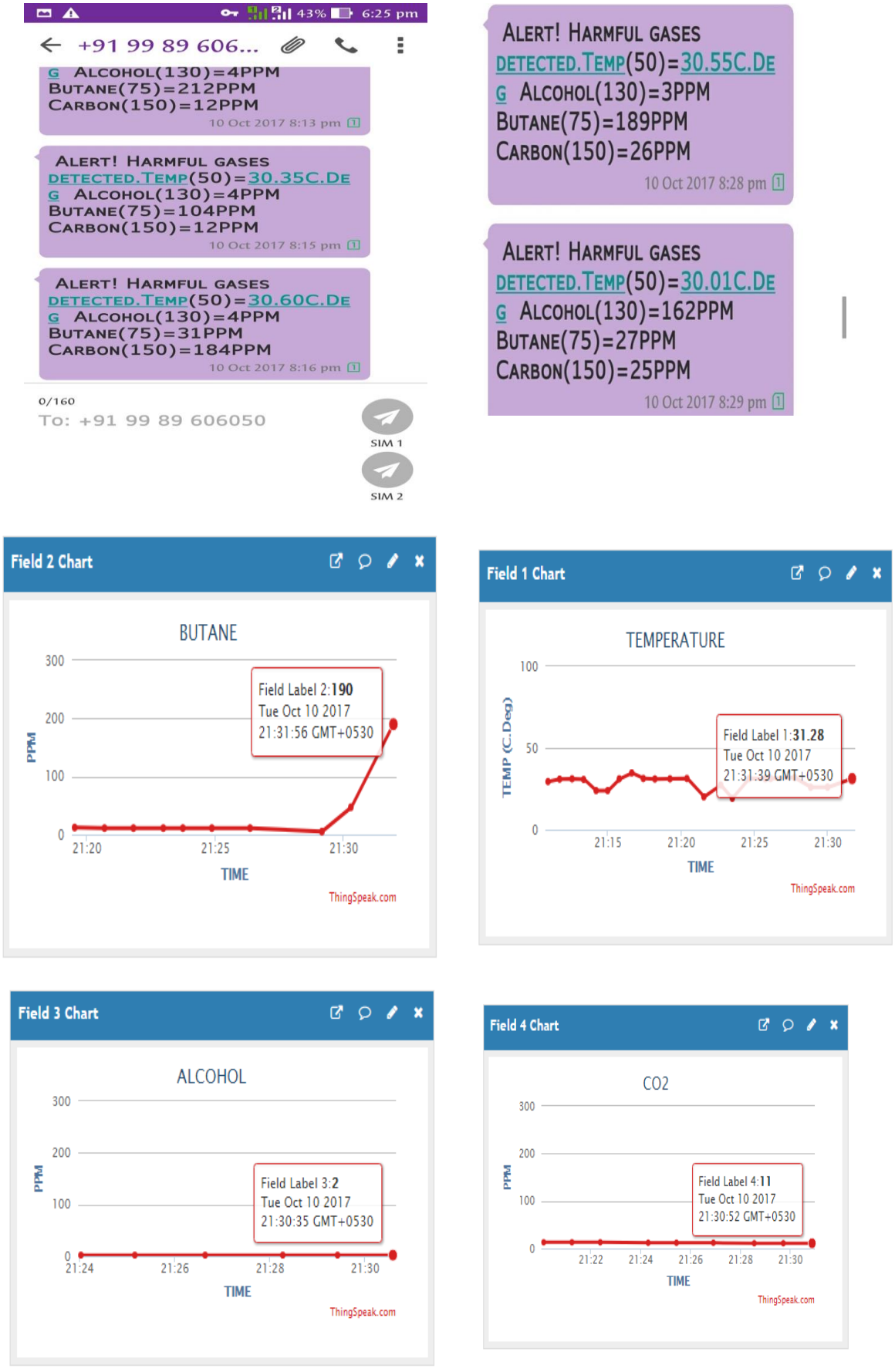


Figure 6 Graphical representation of different gases

4. CONCLUSION AND FUTURE SCOPE

In this work a clever framework for toxic gas and radiation discovery checking cautioning has been created to defeat the drawback looked in more established techniques by utilizing Wi-Fi module and web of things. Consequently the utilization of serial correspondence makes the framework with Arduino controller and IoT. The IoT door associate remote sensor connects with the web, guarantee the operation of the gas and alcohol observing framework. It utilized just constrained sensor. Created application additionally utilized for checking gas and radiation in android portable.

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